

SP-E6 Downstream Extent of Reasonable Control of Feather River Temperature by Oroville-Thermalito

October 25, 2002

1.0 Introduction/Background

Temperatures in the Feather River downstream of the Oroville-Thermalito Complex are managed for a number of purposes. Diversions of water for agriculture, particularly rice fields, in-stream fisheries, and the hatchery all have specific, often conflicting, temperature requirements. Currently temperatures are managed for the agricultural diversions, the hatchery, and at Robinson Riffle in the low flow section of the Feather River between the diversion dam and the Thermalito Afterbay return.

As water flows downstream in any river under a given set of flow and climatic conditions it approaches an equilibrium temperature based on those conditions. This temperature is the same regardless of the starting temperature at the upstream end of the river, if the starting temperature is farther away from the equilibrium temperature then it simply takes longer, or travels farther downstream, to get to the equilibrium temperature. This implies that for a given set of flow and climatic conditions that releasing colder water from the Oroville – Thermalito complex will only impact in-stream Feather River water temperatures for a limited distance downstream where the equilibrium temperature is reached.

The location of this point is critical to know for temperature management purposes at the Oroville – Thermalito complex so that cold water is not wasted attempting to manage temperatures at locations that are simply not physically possible to meet.

2.0 Study Objective

The purpose of this study is to quantify the ability of the Oroville-Thermalito Complex to control temperatures in the Feather River downstream of the Oroville-Thermalito Complex under a variety of operational and climatic conditions. The goal is to determine how far downstream the reservoir can reasonably control temperatures without jeopardizing the cold-water pool availability. This information will be used to assist in management of the Oroville Cold Water Pool and temperature operations of the complex.

3.0 Relationship to Relicensing /Need for the Study

As part of the relicensing process questions have been raised about temperatures in the Feather River downstream of the Oroville-Thermalito Complex and how they could be managed to enhance the fisheries in the area. In order to evaluate fishery impacts of temperature operations it is essential to know how far downstream that the temperatures can be controlled. Without the knowledge it is impossible to set reasonable temperature standards or goals in the Lower Feather River. This issue has been raised in the Environmental Work Group discussions.

The information developed in this study will be useful for several purposes within the relicensing study. These include:

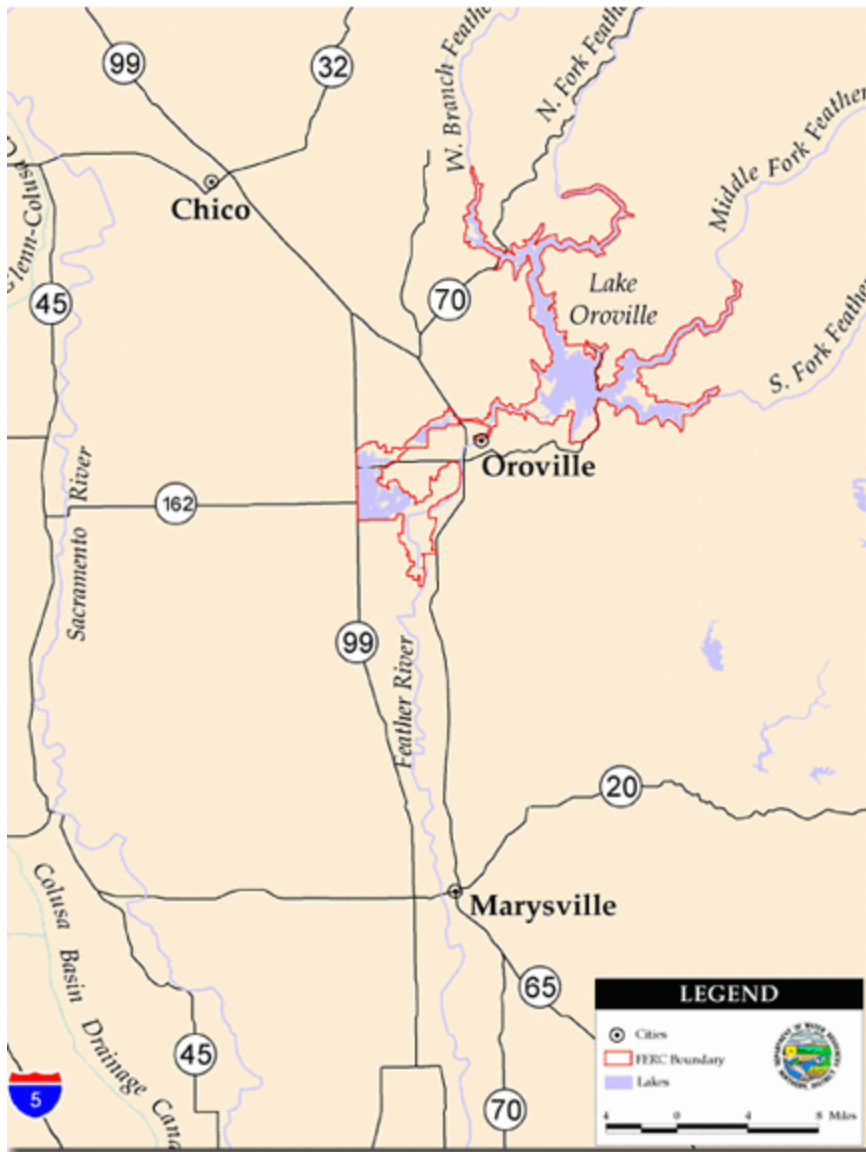
- Focus development/calibrations/verification of the Feather River temperature model to applicable reaches.
- Aid in determining project versus non-project impacts.
- Aid in determining special extent of project temperature impacts.
- Aid in development of temperature operation goals and guidelines for the Oroville Complex.

Engineering and Operations Issues Addressed

- E4—evaluate environmental and economic aspects of different flow regimes of Oroville Facilities operations. Factors to be considered include timing, magnitude and duration of flows, pump-back scheduling and maintenance scheduling, and hatchery operations.
- E6—effect of ramping rates on downstream facilities, power generation, water supply, water temperatures, and fish.
- E12—evaluate operational and engineering alternatives including selective withdrawal from Lake Oroville, Thermalito Afterbay, the hatchery, and the low flow section to meet various downstream temperature requirements
- E14—evaluate operational alternatives that balance and maintain acceptable water quality standards including those for MTBE under all operational plans and conditions.

4.0 Study Area

The scope of this study is the Feather River downstream from the Oroville-Thermalito complex to the confluence with the Sacramento River. If the study shows that it is possible to control temperatures to the Sacramento River the scope may need to be expanded, and the analysis approach re-evaluated. Geographic scope may be refined as additional information is developed and needs are identified through collaboration with other Work Groups.



5.0 General Approach

The study will use an existing temperature computer model of the Feather River from the diversion dam to the confluence with the Sacramento River. This model was used to estimate temperature relationships for operations purposes at Robinson's Riffle. The model will be used with varied assumptions about Oroville-Thermalito temperature operations and other parameters to develop the extent that the Oroville – Thermalito complex can reasonably control temperatures in this reach of the Feather River.

Task 1—Obtain Existing Feather River Temperature Model

This task is to obtain the existing Feather River temperature model and verify the ability to run the model with all required hardware and software.

Subtasks:

- Acquire rights to use RMA-10 and install on a PC. (RMA-10 is a commercial product used as the ‘engine’ to drive the Feather River Temperature model; it has already been verified)
- Obtain model documentation, both RMA-10 and for the input data sets
- Obtain input/output data set(s) for existing model
- Run existing input data sets and verify with existing output datasets

Task 2—Design a Sensitivity Analysis

This task will design the scope of the analysis. This activity will result in a full definition of the combinations of flow, temperature, and climatic conditions to be evaluated under this study. The parameters to be evaluated at a minimum include:

- Oroville Release Rate
- Oroville Release Temperature
- Thermalito Afterbay Release Rate
- Thermalito Afterbay Release Temperature
- Yuba River Inflow Temperature (may be lower in future than in existing data because of on-going activity in Yuba Basin)
 - Yuba River characteristics may be changed due to a temperature-monitoring device to be installed at the Englebright Reservoir dam. This may impact the ability of the Oroville Reservoir to control downstream temperatures.
- Climatic Conditions (Time of year, monthly seasonally)
- Any other significant inflow temperatures (hatchery inflows)

Subtasks:

- Select parameters for inclusion
- Select appropriate ranges for each parameter
- Select appropriate combinations of parameters
- Develop matrix of model simulations to be performed
- Determine placement of nodes for intake temperatures

Task 3—Perform the Model Runs

Subtasks:

- Ensure that the Feather River Temperature model has the capability to perform all simulations developed under Task 2. (This will require coordination with Engineering and Operations Study Plan No. 1 – Model Development.)
- Develop database to store results of model runs
- Setup and run each simulation specified in D above, store results in database

Task 4—Analyze the Results to Define Area of Impacts

Subtasks:

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- Extract data from database
 - Determine downstream temperature profile
 - Determine “reasonable” control distance
 - Develop relationships between parameters and downstream control distance

Task 5—Write Final Report

Complete a report documenting the procedures and results of the evaluation.

6.0 Results and Products/Deliverables

Results

This section to be developed.

Products/Deliverables

The final deliverable of this study will be a report including recommendations on appropriate relationships to use to evaluate ability of Oroville – Thermalito Operations to control temperatures in the Feather River downstream from the Oroville-Thermalito complex to the confluence with the Sacramento River. The report will be suitable for use in other studies to provide guidance on appropriate operation requirements and/or guidelines for temperature in the Feather River downstream from the Oroville-Thermalito complex to the confluence with the Sacramento River.

7.0 Coordination and Implementation Strategy

Coordination with Other Resource Areas/Studies

This study will be coordinated with a number of other Engineering and Operation study plans:

- Study Plan # 1—Model Development
- Study Plan #1c—Oroville Reservoir Temperature Model Development
- Study Plan #1d—Thermalito Complex Temperature Model Development
- Study Plan # 1e—Feather River Temperature Model Development

The development will also be coordinated with study plans from other workgroups that will require Feather River temperature data.

8.0 Study Schedule

This section to be developed.

9.0 References

- Deas M.L., C.L. Lowney, G.K. Meyer, J.D. Anderson, C.B. Cook, J.J. Fellous, M.M. Kirkland, X. Wang, G.T. Orlob, I.P. King (1997), *Sacramento River Temperature Modeling Project – Final Report*, Water Resources and Environmental Modeling Group, Center for Environmental and Water Resources Engineering, Department of Civil and Environmental Engineering, University of California at Davis, January.
- Cook, C.B., O.T. Orlob, Numerical Estimation of Dynamic Water Temperature Fluctuations at Compliance Point Robinson Riffle – UC Davis Feather River Computational Model, Water Resources and Environmental Modeling Group, Center for Environmental and Water Resources Engineering, Department of Civil and Environmental Engineering, University of California at Davis, May 2000.